Description of *Perotrochus boucheti* sp. nov. from the South Pacific (Gastropoda: Pleurotomariidae)

Patrick ANSEEUW
Mispelstraat, 18, 9820 Merelbeke, Belgium

Guido T. POPPE
Stanislas Leclefstraat 8, 2600 Berchem, Belgium

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ABSTRACT. *Perotrochus boucheti*, a new pleurotomariid species is described from SE New Caledonian waters, Loyalty Islands and Vanuatu (New Hebrides) in the South Pacific.

INTRODUCTION

P. boucheti is closely related to other *Perotrochus* species from the Indo-West Pacific such as *P. africanus* Tomlin, 1948, *P. teramachii* Kuroda, 1955, *P. tangaroana* Bouchet & Métivier, 1982 and *P. westralis* (Whitehead,1987). Consistent differences in colour of teleoconch and base, sculptural pattern of basal disc and selenizone, shape of aperture and proportion of surface area covered by the umbilical region callus pad on basal disc allow separation on specific level.
This represents the fourth species of living *Perotrochus* in the South Pacific.

SYSTEMATICS

Order **VETIGASTROPODA** Salvini-Plawen, 1980
Superfamily **PLEUROTOMARIACEA** Swainson, 1840
Family **PLEUROTOMARIIDAE** Swainson, 1840
Genus ***Perotrochus*** P. Fischer, 1885

Perotrochus boucheti sp. nov.
pl. 1, figs 1-4, pl. 2, figs 1-9

Type Material

Holotype and 10 paratypes, all in Muséum national d'Histoire naturelle, Paris, France
Chronological list of stations yielding specimens of *P. boucheti*, with reference to the type material:

Biocal, Sept.1985, Jean Charcot, entre Ouvéa et Lifou 24°55'S - 168°22'E, 500-510 m (**paratype 1**: 96.2 x 73.6 mm).
Chalcal 2, Octob. 1986, N.O. Coriolis, Sud Nouvelle Calédonie, 24°55'S - 168°22'E, 527 m (**paratype 2**: 92.2 x 73.2 mm).
Smib 3, May 1987, N.O. Vauban, Nouvelle Calédonie, 23°37'S - 167°42'E, 448 m (**paratype 3** : 100.4 x 75.7 mm).
Smib 4, March 1989, N.O.Alis, Sud Nouvelle Calédonie, 24°55'S - 168°22'E, 510-515 m (**holotype** & **paratype** 4 : 76.1 x 59.9 mm; **paratype 5** : 79.8 x 62.3 mm; **paratype 6**: 94.6 x 73.2 mm).
Volsmar, June 1989, N.O.Alis, Rides des Loyauté, 22°12'S - 168°37,5'E, 480-540 m (**paratype 7**: 85.0 x 66.5 mm).
Beryx 11, Octob.1992, N.O. Alis, Sud Nouvelle Calédonie 23°39'S - 167°44'E, 430-440 m (**paratype 8**: 101.5 x 75.0 mm).
Lithist, Aug. 1999, N.O. Alis, Sud Nouvelle Calédonie, Banc Stylaster, 23°37.1'S - 167°41.1'E, 442 m (**paratype 10**: 92.3 x 72.0 mm); Sud Nouvelle Calédonie, Banc Eponge, 24°54.2'S - 168°21.3'E, 540 m (**paratype 9**: 42.4 x 31.1 mm).

Other localities (all in MNHN).

Biocal, Sept 1985, Jean Charcot, Ouvéa, 20°35'S - 166°54'E, 460 m.
Beryx 11, Sud Nouvelle Calédonie 23°42'S - 167°59'E, 338 m.
Smib 8, January 1993, N.O. Alis, Sud Nouvelle Calédonie, Banc Eponge, 24°54.3'S - 168°22.2'E, 514-530 m; Sud Nouvelle Calédonie, Banc Stylaster, 23°37.8'S - 167°42.7'E, 433-450 m
Bathus 3, Nov. 1993, N.O. Alis, Ride de Norfolk 23°45'S - 168°16'E, 478-486 m
Musorstom 8, Octob. 1994, N.O. Alis, Vanuatu 15°05'S - 167°15'E, 405-419 m.

Comparative material examined

Perotrochus africanus Tomlin, 1948.
Coll. Sévérac, France: Madagascar, off the NW coast, 12°06.5'S - 49°26.3' E, 300 m;
Coll. Anseeuw, Belgium: South Africa, Natal, 40 km straight out of Durban, 516 m;

Coll. Anseeuw, Belgium: Mozambique, south coast, off Punta do Ouro, 250 m.

Perotrochus teramachii Kuroda,1955

MNHN, France: Trawled off SW Taiwan in 100 fth (commercial sources);

MNHN, France: Musorstom 3; Philippines; St. 105: 13°52.6'N - 120°29.6'E, 386-369 m;

MNHN, France: Musorstom 3; Philippines; St.128: 11°50.7'N - 121°42'E, 815-821 m;

Coll. Anseeuw, Belgium: trawled 10 km south off Daio-Zaki, Mie Prefect., Japan, in 240 m (commercial sources);

Coll. Anseeuw, Belgium: trawled 100 km south-west of Tung Kang, SW Taiwan in 500 m (commercial sources);

Coll. Anseeuw, Belgium: trawled off Nagasaki, Japan in 200-300 m (commercial sources);

Coll. Anseeuw, Belgium: trawled SE of Saigon, South China Sea, 10°40'N - 109°40'E;

Coll. Anseeuw, Belgium: trawled on muddy sand off Kuro Island, SW of Kagoshima City, East China Sea in 300-380 m (commercial sources);

Coll. Anseeuw, Belgium: in bottom net by native fisherman off Panglao, Bohol, central Philippines in 120 fth.

Perotrochus westralis (Whitehead, 1987)

MNHN, France: Corindon IV (14/4/1981) Piru Bay, Ceram Island, The Moluccas in 525-562 m;

MNHN, France: Karubar-Indonesia (October 1991) Kai-Islands: 5°24'S - 132°28'E in 354-389 m; 5°23'S - 123°37'E in 436-413 m; 5°21'S - 132°30'E in 360-405 m;

Coll. Anseeuw, Belgium: trawled by commercial prawn boats off Port Hedland, NW Australia in 460-500 m, on muddy bottom;

Coll. Anseeuw, Belgium: trawled by prawn boats near Scott Reef, NWAustralia, in 500 m;

Coll. Anseeuw, Belgium: trawled East of Mermaid Reef, NW Australia 119°50'E - 17°6'S.

Perotrochus tangaroana Bouchet & Métivier, 1982

New Zealand Oceanograph. Institute, Wellington, New Zealand: Holotype:R/V Tangaroa off Lau Ridge. New Zealand (June 1980) 179°04'W - 25°14'S in 547 - 646 m (pumice substrate);

New Zealand Oceanograph. Institute, Wellington, New Zealand: trawled Stat. U. 594 (7/2/1988) 30°20.1'S - 172°59.6'E in 406 m;

Coll. Anseeuw, Belgium: trawled near Norfolk Island (?) South Pacific, in about 500 m.

Perotrochus indicus Anseeuw, 1999

MNHN, France, Holotype: trawled in the Bay of Bengal, India (near Andaman Islands) in about 300 m (commercial sources).

Dimensions of the holotype

Maximum basal diameter: 89.4 mm; minimum basal diameter: 75.5 mm.

Maximum height: 69.0 mm.

Depth of the slit along the upper margin: 51.4 mm, along the lower margin: 36.1 mm.

Width (axis) aperture: 44.7 mm. Height aperture: 36.1 mm.

Operculum maximum diagonal axis: 25.4 mm. Shell weight: 35 g.

Range and habitat

Found alive by several oceanographic expeditions (1985-1999) in the South Pacific. The range extends from Southeast New Caledonia to the Loyalty Islands and north to Vanuatu.

The depth varies between 215 and 580 m, with an average of 482 m (22 specimens). The finding of a living *P. boucheti* in a depth of only 215 m is considered exceptional.

Soft parts are preserved in 70% ethanol. Several specimens were found together with sponges (*Corallistes*, Hexactinellidae) and gorgonians in the dredge. Most often *P. boucheti* was taken from shell gravel bottoms, or on shell sand. Cirripeda and Zooantherians are occasionally attached to the outer surface of the shell.

Description

Shell trochoid, large in size (up to 108 mm basal diameter), with a mean spire angle of 92°, solid and relatively thick, with a false umbilicus.

Spire distinctly gradate, low turbiniform, with well impressed sutures.

Protoconch finely sculptured, opalescent creamy-white, with 1 1/2 whorls, contrasting in color with the first apical whorls (2-3) which are characteristically solid rose or light pinkish.

Sculpture of teleoconch consisting on the body-whorl of numerous predominant fine, not beaded, spiral cords. These fine spiral cords number more than 28 in the area above the selenizone, they weaken towards the suture and disappear to the naked eye in the vicinity of the suture.

Apical whorls have more predominant very fine axial growth riblets. When crossed by the fine spiral cords they produce a fine network, visible in the very early apical whorls only.

Below the selenizone, the spiral cords are dominant and well marked, more than 15 in number on the body-whorl. In the whorls above the body whorl, the sculpture becomes very fine, almost microscopic, giving a near smooth, shiny appearance to the surface of the earlier whorls.

The selenizone is rather flat in profile or very slightly sunken. No dominant spiral cords are visible macroscopically. However, under magnification, very fine semicircular ophistocirt growth lirae are well visible, and 2 inconspicuous spiral cords can be observed running all along the selenizone.

Aperture is ovate and depressed, much as in *P. africanus* Tomlin, 1948.

Width of the slit is average compared to other members of the genus (4.1 mm in the holotype). The slit is situated slightly above the midwhorl. The upper margin above the slit, projects markedly (31,3 % in average) over the lower margin. The mean slit-depth is 1/5.9 of the mean circumference of the body-whorl.

Columella sigmoidally curved in S-shape, solidly constructed, slightly thickened, and well covered by nacre. It extends to an adjacent, non-edged, nacreous umbilical callus, which takes up 20% in relation to the radius of the basal disc.

An umbilical hole (false umbilicus) is apparent at the center of the basal disc.

Base moderately convex in shape, somewhat angled at the periphery of the body whorl, with well marked fine, non granular spiral cords, over 55 in number, between the periphery and the umbilical callus-pad.

In some specimens the densely crowded fine spiral cords can give the impression of a rather smooth, lustrous surface.

Color of teleoconch and base is dominated by the merging of flammulations into a solid deep golden-pink to deep-orange overall covering, with only very sparse whitish cream background color areas on the teleoconch. Slightly iridescent surface. A deep red contrasting color borders the rims of the selenizone, generally well marked on the earlier whorls. Some deep-red semi-circular lunular lines cover irregularly the surface of the selenizone, particularly on the body-whorl. Aperture inside is completely covered by a relatively thick nacreous layer, with greenish overtones. A very fine orange, porcellaneous space borders the edges of the inner slit-margins. Adapical whorls solid light rose with contrasting white protoconch on top.

Operculum light brown, thin multispiral (about 10 turns), corneous and relatively large, but just under half the size of the maximum diagonal axis of the aperture.

Discussion – Remarks

The new *P. boucheti* belongs to the well known *P. africanus* complex (Wagner & Coomans, 1990). This group contains *P. africanus*, *P. teramachii*; *P. diluculum* Okutani, 1979; *P. tangaroana*; *P. westralis* and *P. indicus*. Their ranges are scattered all over the Indo-West Pacific (See distribution map). Further genetic and electrophoretic studies of the animals will clarify the true relationship between these different taxa (cf. Okutani & Kurata, 1998).

We need further well documented samples of freshly preserved material, especially from the bridging areas between taxa. A practical problem is the fact that most of the known *Perotrochus* only become available through commercial sources, which often lack precise data.

Taxonomically, we consider for the moment, these taxa as valid isolated species because of their long isolation and the absence of genetic exchange. This tends to produce a number of "settled identifiable geographically isolated populations" (cf. Bouchet & Métivier, 1982), which is still a valuable argument today.

Populations of some *Perotrochus*-species are very large, both in number of specimens and in the extent of their range. Despite this, the conchological characteristics remain clear-cut and "transitional forms" are hitherto unknown.

The presently described populations of *P. boucheti* are also homogeneous in conchological characters. Multiple sampling over a long period demonstrate a geographical isolation, caused by the South Fiji Basin, from its closest neighbour *P. tangaroana*. To the northwest, its closest neighbour is *P. westralis*, which has a range from northwest Australia to southern Indonesia. No intermediate samplings of related *Perotrochus* have been recovered as yet between the southernmost point of the range of *P. teramachii* (Sibutu-Passage, Philippines) and the present species.

Detailed description of conchological characters alone, allows us to separate this 7th taxon from the other 6 related *Perotrochus*.

From its closest geographical relative, *P. tangaroana* (from Three Kings Rise and North New Zealand) *P. boucheti* can be easily separated by its solid deep orange to pink coloration of teleoconch and basal disc and by its more flattened apertural shape.

P. westralis from northwest Australia and southern Indonesia is distinguished by its macroscopically smooth basal disc and the equally smooth areas on the teleoconch above the selenizone. *P. westralis* also has a more subcircular outline of the aperture and well marked spiral ribs on the selenizone.

P. africanus resembles this new taxon most in general sculpture, thickness of shell (weight in proportion to shell-diameter/height) but the mean spire angle of *P. boucheti* is somewhat larger (92°) in comparison to *P. africanus* (mean angle 88°), resulting in a more depressed shell shape. The callus pad area covering the umbilical region is larger in *P. africanus* (32%) when compared to the callus pad area in the new taxon (21%).

Another close relative is *P. teramachii*, from which it can be separated by the absence of a typical network sculpture on the teleoconch as clearly seen in most *P. teramachii*. The adult shell in *P. teramachii* reaches generally a larger size. The adapical whorls in *P. teramachii* are generally dull creamy-white in colour as is the protoconch, whereas in the new taxon the adapical whorls are solid light pink in colour, contrasting with a white protoconch on top. This difference is well marked when both species are viewed apically. In the new species no radial ribs are visible running on the surface of the selenizone on the bodywhorl, whereas in *P. teramachii* 2 to 5 spiral cords can generally be seen.

P. diluculum can be easily separated from the *P. boucheti*, by its silvery color on teleoconch and basal disc, blunt apex (apical angle more than 110°) and its macroscopically nearly smooth surface of the teleoconch.
P. indicus has a much more gradate trochoid apex and a smaller adult size. *P. boucheti* has, compared to *P. indicus*, a finer spiral sculpture on the basal disc and a more depressed aperture (apertural shape max.diam max.height = 1.33 in comparison to 1.24 in *P. indicus*).
For further details on the comparison between different *Perotrochus* we refer to the table below.

Derivatio nominis

The present species is dedicated to Philippe Bouchet, Laboratoire de Biologie des Invertébrés marins et de Malacologie, Muséum National d'Histoire Naturelle in Paris, France, the true driving force behind the great activity in malacological exploration in the Pacific in modern days, especially of the rich faunal region of New Caledonia and adjacent waters.

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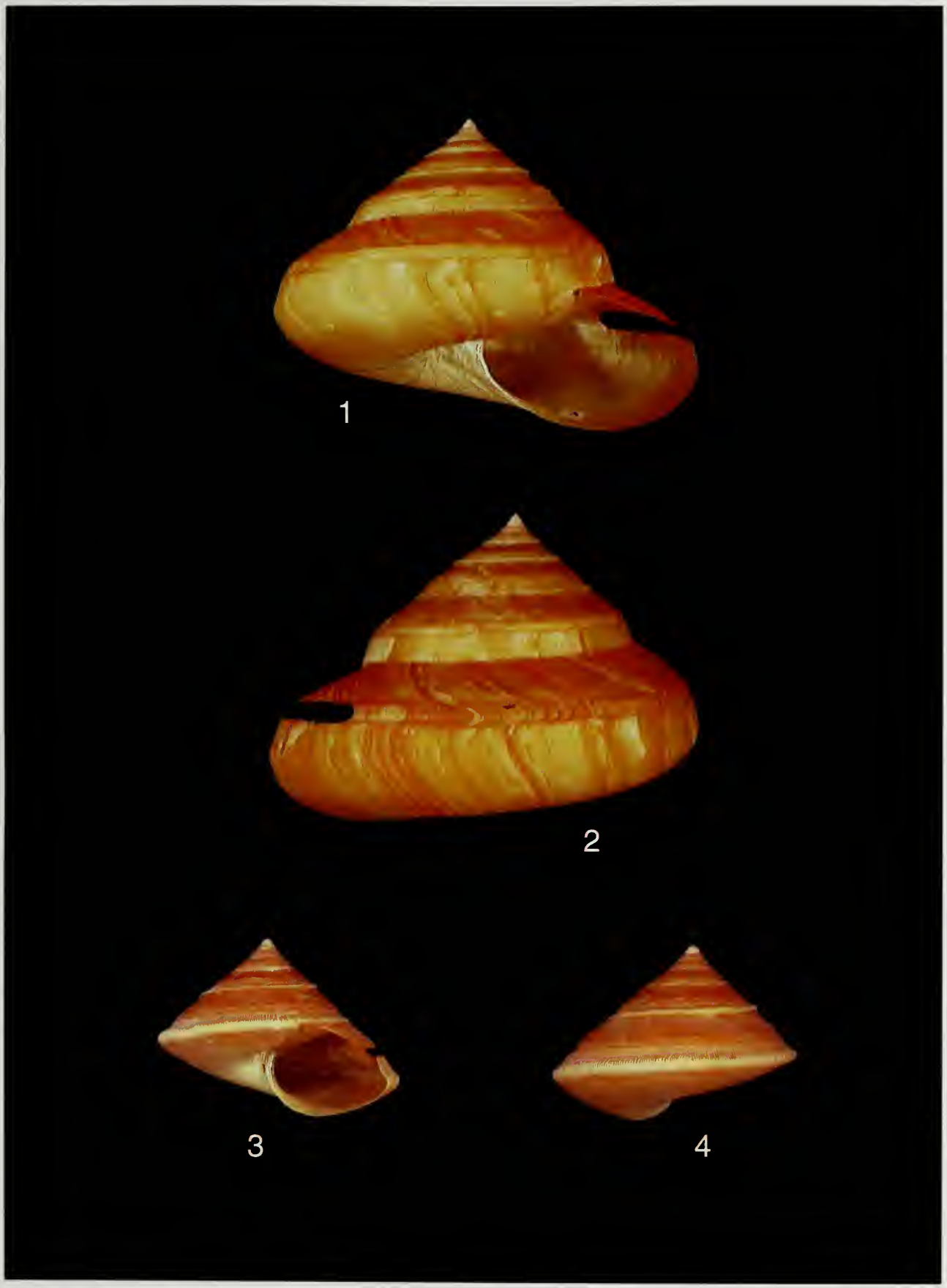
	Ratio D/H	Apertural shape A/B	Mean spire angle °	Callus pad extension in umbilical region of basal disc *	% Extension of upper slit lip over lower slit lip	Slit length proportion to circumference of body whorl	Number of radial ribs visible on selenizone body whorl
***P. africanus* Tomlin, 1948**	1.17 (n = 10)	1.39 (n = 10)	88° (n = 10)	32 % (n = 10)	29.5 % (n = 10)	1/5.6 (n = 8)	3 ribs (n = 6) 2 ribs (n = 3)
***P. teramachii* Kuroda, 1955**	1.22 (n = 14)	1.26 (n = 12)	94° (n = 14)	18 % (n = 14)	28.6 % (n = 13)	1/6.1 (n = 9)	4 – 5 ribs (n = 6) 2 – 3 ribs (n = 5)
P. westralis (Whitehead, 1987)	1.22 (n = 18)	1.17 (n = 18)	89° (n = 18)	18 % (n = 18)	27.1 % (n = 17)	1/6.0 (n = 17)	smooth (0) (n = 11) (2) inconspicuous (n = 5)
***P. boucheti* sp. nov.**	1.28 (n = 10)	1.26 (n = 17)	92° (n = 17)	20 % (n = 17)	30.3 % (n = 17)	1/5.7 (n = 17)	smooth (0) (n = 14) (2) inconspicuous (n = 3)

Comparative table of selected shell characteristics
D = maximal diameter - A = maximal (diagonal) width aperture - H = maximal shell height - B = maximal height aperture - *= surface radius of basal disc - n = number of specimens measured.
Only adult specimens with, in general, more than 7 teleoconch whorls were used. Not all characteristics are visible in all of the shells, which explains differences in the number of specimens compared.

Plate 1.
1-4. *Perotrochus boucheti* Anseeuw & Poppe, sp. nov.
1. Holotype. 89.4 x 69.0 mm: Apertural view. **2.** Holotype. 89.4 x 69.0 mm: Profile view. **3.** Paratype 9. 42.4 x 31.1 mm: Apertural view. **4.**Paratype 9. 42.4 x 31.1 mm: Profile view.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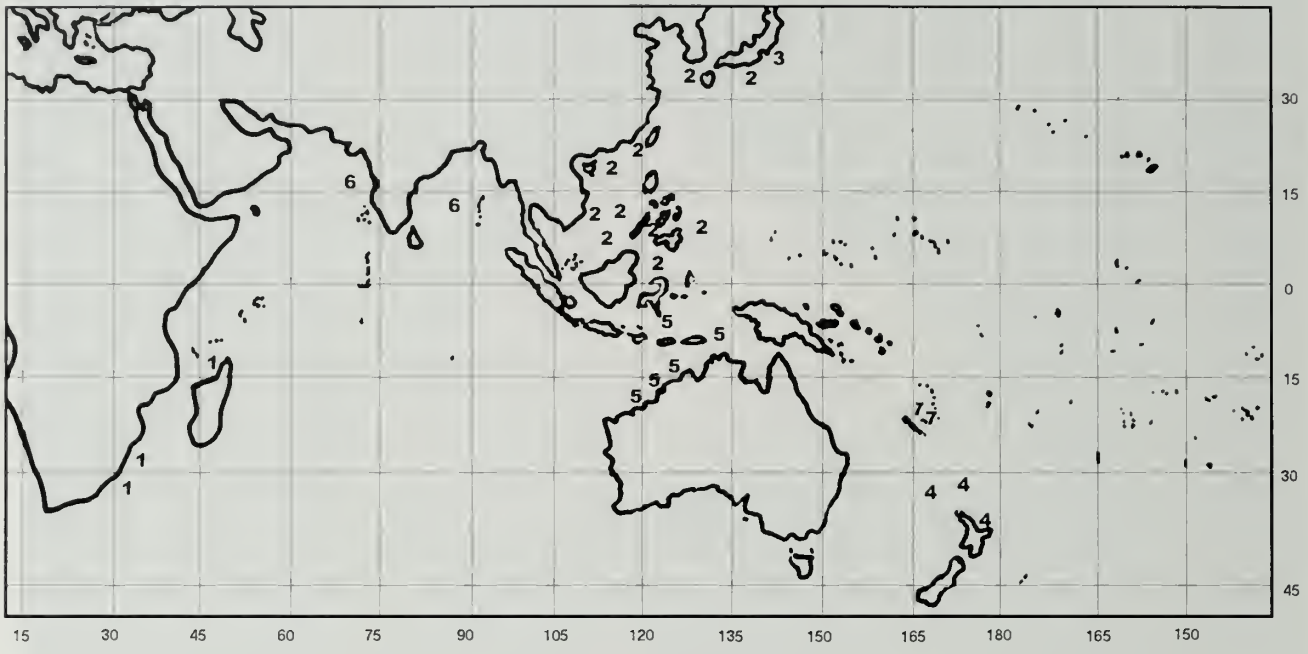
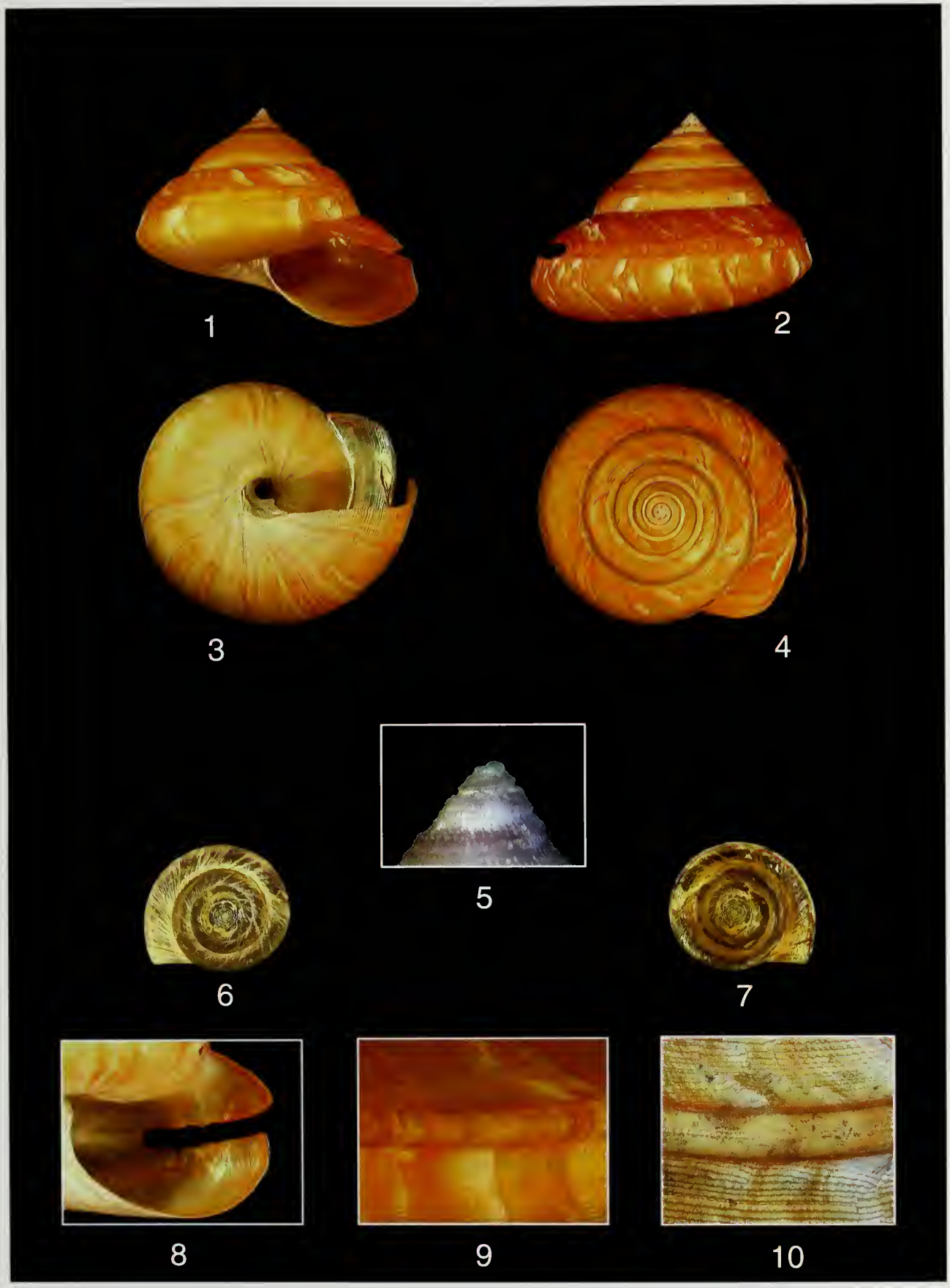


Geographical distribution: *Perotrochus africanus*-complex:

1. *P. africanus* Tomlin, 1948 - **2.** *P. teramachii* Kuroda, 1955 – **3.** *P. diluculum* Okutani, 1979 – **4.** *P. tangaroana* Bouchet & Métivier, 1982 – **5.** *P. westralis* (Whitehead, 1987) – **6.** *P. indicus* Anseeuw, 1999 – **7.** *P. boucheti* nov. sp.

Plate 2.
1-9. *Perotrochus boucheti* Anseeuw & Poppe, sp. nov.
1. Paratype 10. 92.3 x 72.0 mm: Apertural view. 2. Paratype 10. 92.3 x 72.0 mm: Profile view. 3; Holotype. 89.4 x 69.0 mm: Basal view. 4. Holotype. 89.4 x 69.0 mm: Apical view. 5. Holotype: Protoconch. 6. Holotype: Operculum (interior). 7. Holotype: Operculum (exterior). 8. Holotype: Aperture. 9. Holotype: Selenizone.
10. *P. teramachii* Kuroda, 1955: Selenizone.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